KLEINFELDER
Bright People. Right Solutions.

316A VARIANCE PERMIT MODIFICATION REQUEST

FOR THE

AMEREN LABADIE ENERGY CENTER

MISSOURI STATE OPERATING PERMIT NO. MO-0004812

AUGUST 9, 2019

150 College Road West, Suite 100, Princeton, NJ 08540 **p** | 609.924.8821 **f** | 609.924.8831

Executive Summary

Discharge of cooling water from Ameren's Labadie Energy Center (the Facility) is regulated by Missouri State Operating Permit MO-0004812, a National Pollutant Discharge Elimination System ("NPDES") permit. That permit includes a schedule of compliance which required Ameren to conduct a biological monitoring program in accordance with 40 CFR 125 Subpart H to evaluate the impact of thermal discharges. Subpart H of 40 CFR 125 addresses "Criteria for Determining Alternative Effluent Limitations Under Section 316(a) of the [Clean Water] Act". Ameren was also required to submit a report detailing the results of the monitoring program and a recommendation as to whether reissuance of a 316(a) variance was supported by the findings of the monitoring program. That monitoring program and associated report (*Labadie Energy Center §316(a) Final Demonstration*, prepared by ASA Analysis & Communication, Inc., August 8, 2019) have been completed, and the report supports the reissuance of a 316(a) variance.

In performing its evaluation of the data from the monitoring program, ASA considered whether the Facility's past and current operation has resulted in appreciable harm to the balanced indigenous community (BIC) of fish, shellfish and wildlife in the Missouri River in the vicinity of and downstream of the Facility's discharge. The Facility has been in operation for approximately fifty years, and during that period it has operated in compliance with prior 316(a) based thermal effluent limitations that are less stringent than the applicable water quality based effluent limitation (WQBEL). In completing its evaluation, ASA considered all regulatory requirements and a number of other criteria sometimes used to further evaluate whether appreciable harm to the BIC has occurred. They concluded that the decision criteria were satisfied indicating that (1) no prior appreciable harm has occurred as a result of the Facility's ongoing thermal discharge, and (2) continuing to allow a 316(a) variance (as defined below) will assure the protection and propagation of a BIC in the Lower Missouri River.

Based on these findings it is apparent that an alternate thermal effluent limitation less stringent than the WQBEL can be permitted without an expectation of appreciable harm to the BIC. Indeed, the showing of no appreciable harm by ASA supports continuation of the prior 316(a) variance thermal effluent limitations. Ameren, however, is instead requesting alternate thermal effluent limitations which are substantively the same as the WQBEL currently in effect in the NPDES permit with (1) an exception to account for infrequent extreme river conditions,

and (2) a formula improvement to more precisely account for certain discharge temperature ranges. These alternate thermal effluent limitations are consistent with continued operation of the Facility in a manner in which it has been operated for many years, the consequence of which has been no appreciable harm to the BIC. This variance can be easily incorporated in the Permit via (1) the addition of a Note to Table A-2 of the Permit, and (2) modification of the current Note 4 of Table A-2 of the Permit.

Table of Contents

PAGE

I. Background 1

II. Basis for a 316(a) Variance 6

III. Proposed Alternate Effluent Limitations 15

IV. 316(A) Variance Request 17

List of Tables

PAGE

Table 1: Recommended Permit Modification to Accommodate Low Temperature Rise 21

I. BACKGROUND

Ameren Missouri ("Ameren") operates the Labadie Energy Center (the "Facility") located at 226 Labadie Power Plant Road in Labadie, Missouri. Discharges from the Facility are regulated by Missouri State Operating Permit MO-0004812, a National Pollutant Discharge Elimination System ("NPDES") permit issued by the Missouri Department of Natural Resources ("DNR") under the authority of the federal Clean Water Act ("CWA") and the Missouri Clean Water Law.

The current NPDES permit was issued for the Facility with a September 1, 2018 effective date (the "Permit"). Its Section D.3 provides a "Schedule of Compliance – Thermal Discharges"[1] which required Ameren to re-establish a biological monitoring program in accordance with 40 CFR 125 Subpart H to evaluate the impact of thermal discharges.

Subpart H of 40 CFR 125 addresses "Criteria for Determining Alternative Effluent Limitations Under Section 316(a) of the [Clean Water] Act". Section D.3 of the Permit also specifies a schedule for the biological monitoring program which, in accordance with 40 CFR 125 Subpart H, was to be conducted by Ameren for "*water quality and biological assessments necessary to assure the protection and propagation of a balanced, indigenous community of fish, shellfish, and invertebrates in the Missouri River downstream in the vicinity of the plant's thermal discharge*". Section D.3.b of the Permit further requires:

> *"Six months prior to permit expiration, the permittee shall submit a report detailing how [sic] the results of the monitoring program and the recommended path forward to achieve compliance. If a recommendation of the report is reissuance of the 316(a) variance, then a request for reissuance of the 316(a) variance must be*

[1] See Section D.3, page 16 of 16, of the Permit referencing requirements of Section D.2.d of the NPDES permit issued by the Facility with an effective date of August 1, 2015 (the "2015 Permit"). The requirements of Section D.2.d of the 2015 Permit were continued without substantive change as Section D.3 of the subsequent permit modification effective May 3, 2017 (the "2017 Modified Permit").

submitted detailing how the monitoring program supports the requirements of no appreciable harm…"[2]

That monitoring program and associated report (*Labadie Energy Center §316(a) Final Demonstration*, prepared by ASA Analysis & Communication, Inc., August 8, 2019) have been completed. And, as summarized below, the report supports issuance of a 316(a) variance.

Over the past several years, Ameren has undertaken extensive field work and thermal modeling of the Missouri River as required by, and in support of, the Permit. That work has been presented in the following series of reports (listed below chronologically by date of the report):

1. *Thermal Plume Modeling and NPDES Permit Effluent Limitations for the Ameren Labadie Energy Center Missouri State Operating Permit No. MO-0004812*, prepared by Kleinfelder, dated October 27, 2016. This report (a) presented the development and validation of a mathematical model of temperature distribution in the Missouri River, (b) thoroughly evaluated the impact of the Facility discharge on that temperature distribution, and (c) presented an improved method for expressing thermal effluent limitations in the NPDES permit for the Facility.

2. *Supplemental Report Thermal Plume Modeling and NPDES Permit Effluent Limitations for the Ameren Labadie Energy Center Missouri State Operating Permit No. MO-0004812*, prepared by Kleinfelder, dated February 10, 2017. This report presented additional modeling and analysis of the temperature distribution in the river and developed an algorithm for calculating the size of the thermal mixing zone for incorporation in the Facility's NPDES permit.

3. *Second Supplemental Report Thermal Plume Modeling and NPDES Permit Effluent Limitations for the Ameren Labadie Energy Center Missouri State Operating Permit No. MO-0004812*, prepared by Kleinfelder, dated November 30, 2017. This report

[2] In the 2015 Permit, this statement is listed in the Schedule of Compliance as Section D.2 subparagraph (b) on page 12 of 13.

included an additional validation of the model with the results of a temperature data survey in the river conducted by Ameren in July 2017.

4. *Determination of Appropriate Thermal WQBEL and TBEL for the Ameren Labadie Energy Center Missouri State Operating Permit No. MO-0004812*, prepared by Kleinfelder, dated March 5, 2018. This report considered the applicability of water quality based and technology based thermal effluent limitations for the Facility, concluding that the water quality based limitations, as defined in the prior reports, were more stringent than the technology based effluent limitations for once through cooling with an artificial discharge channel.

5. *Thermal Discharge Effects of Labadie Energy Center on Aquatic Ecology in the Lower Missouri River,* prepared by Charles C. Coutant, Ph.D., originally dated March 2018 with an update April 2019. This report found that (a) the ecology of the Lower Missouri River is not being harmed by existing thermal discharges from the Facility, (b) any reduced thermal discharge estimated to result from alternative thermal control technologies implemented for the Facility cannot reasonably be expected to meaningfully improve or alter river ecology, and (c) results from the complete biological monitoring program are highly likely to conclude that the Facility's receiving waters reflect a balanced indigenous community (BIC) of shellfish, fish and wildlife under CWA Section 316(a).

6. *Engineering and Operational Controls to Achieve Compliance with Final Thermal Effluent Limitations during Extreme River Conditions for the Ameren Labadie Energy Center Missouri State Operating Permit No. MO-0004812*, prepared by Kleinfelder, dated June 18, 2018. This report was prepared in satisfaction of the NPDES permit's Schedule of Compliance Section D.3[3] and presents an evaluation of engineering and operational controls that can be implemented at the Facility to further enhance compliance with the permit's thermal effluent limitations under extreme conditions of low flow and high temperature in the river. This report also included an updated

[3] This condition first appeared in the 2017 Modified NPDES Permit.

method for expressing the Facility's thermal effluent limitations to account for the implementation of operational controls during extreme conditions in the river.

7. *Labadie Energy Center 316(a) Interim Demonstration,* prepared by ASA Analysis & Communication, Inc., dated August 31, 2018. This report presented the results of the first year of the water quality and biological study being conducted in satisfaction of the above-mentioned NPDES permit requirement, concluding that the Facility discharge has not caused appreciable harm to the BIC and will continue to assure protection and propagation of a balanced indigenous community in the vicinity of the Facility and the lower Missouri River as a whole.

8. *Labadie Energy Center §316(a) Final Demonstration*, prepared by ASA Analysis & Communication, Inc., August 8, 2019; hereafter referred to as "ASA 2019." This report presents the results of the complete water quality and biological monitoring program conducted in satisfaction of the above-mentioned NPDES permit requirement, supporting a 316(a) variance.

As noted above, the 2015 Permit was issued to the Facility with effective date August 1, 2015. The above body of work has contributed to the basis for two subsequent permit actions affecting the Facility's thermal effluent limitations as follows:

1. The 2017 Modified Permit replaced (a) the interim heat load thermal effluent limitation and (b) the methodology for calculating compliance with the final thermal effluent limitation, with the improved Thermal Discharge Parameter (TDP) as the interim and final thermal effluent limitations. This modification also included (i) changes to the Schedule of Compliance for thermal discharges requiring an evaluation of engineering and operational controls, and (ii) an exception to the interim thermal effluent limitations during the schedule of compliance when extreme low flow and high temperature might occur in the river. The effective date of the modification was May 3, 2017. The current Permit (2018) retained the interim and final thermal effluent limits established by the 2017 Modified Permit.

2. Termination of the interim thermal effluent limitations of the 2017 Modified Permit on August 1, 2018 via letter of July 11, 2018 from Michael Abbott, Chief, Operating Permits Section, DNR. The final thermal effluent limitations became effective August 1, 2018, two years earlier than previously required in the Permit.

The net effect of these actions was to significantly accelerate application of the final thermal effluent limitations. However, as demonstrated by ASA 2019 and below, those final thermal effluent limitations are more stringent than necessary to assure the protection and propagation of a BIC. Accordingly, as contemplated by Section D.3.b of the Permit, Ameren requests issuance of an alternative effluent limitation (commonly referenced as a "variance") under CWA Section 316(a) for the Facility's thermal discharges from Outfall 001. Parts II - IV below detail the basis of the requested variance and propose alternative thermal effluent limitations.[4]

[4] Section D.3.b.4 of the Permit suggests that a variance request could include "alternative measurement methodologies or criteria, alternative thermal effluent limitations or an alternative schedule to implement physical and/or operational modifications as may be warranted."

II. BASIS FOR A 316(A) VARIANCE

In its prior NPDES permits, the Facility was granted a heat rejection effluent limit of 11.16 x 10^9 BTUs/hr. This effluent limitation was permitted via a 316(a) variance. By definition, it was less stringent than the applicable water quality based effluent limitation (WQBEL). The Facility operated in compliance with that effluent limitation for many years. The 2015 Permit retained 11.16 x 10^9 BTUs/hr as an interim limitation but imposed a final WQBEL. During the compliance period for the interim thermal effluent limitation, the 2015 Permit also required Ameren to conduct the aforementioned biological monitoring program to assess biological conditions. The 2015 Permit further contemplated the possibility that such studies could support an application for a 316(a) variance and invited Ameren to do so if desired. In other words, Ameren's NPDES permit contemplated reissuance of a 316(a) variance if it could be supported by the findings of the biological monitoring program.

In May 2017 the Facility's NPDES permit was modified to include an updated WQBEL (the TDP) for both the interim and final effluent limitations. Compliance with the TDP limitations would always result in compliance with the receiving water quality standards. An exception to this WQBEL was allowed with respect to the interim limitation during extreme low flow and/or high temperature in the river. Also, the permit continued the requirement for completion of the biological monitoring program, once again contemplating a possible reissuance of a 316a variance if it could be supported by the findings of the biological monitoring program.

The biological monitoring program required by the Permit (and the 2015 Permit and 2017 Modified Permit) has been completed extending over the course of the past three years. The effort started with an approximately one-half year thorough process to develop a work plan prescribing the elements of the monitoring to be undertaken. In accordance with the approved work plan, monitoring was conducted over a two year period. Data analysis was ongoing throughout the monitoring period. Final evaluation of the data required an additional one-half year effort. A detailed presentation of the results of the entire monitoring program is provided in ASA 2019.

In performing its evaluation of the data from the monitoring program, ASA considered whether the Facility's past and current operation has resulted in appreciable harm to the aquatic biota in the Missouri River in the vicinity of and downstream of the Facility discharge and whether the

proposed alternative effluent limitations for temperature will assure the continued protection and propagation of the balanced indigenous community into the future[5]. In completing this evaluation, ASA considered all regulatory requirements and a number of other criteria sometimes used to further evaluate whether appreciable harm has occurred. ASA's findings on each of the criteria is summarized below[6]:

1. *Presence of all trophic levels*

   The area in the vicinity of the Facility thermal discharge was considered an area of low potential impact for phytoplankton, zooplankton, and habitat formers, i.e., components of the lower trophic levels of the food chain. The data collected demonstrated equal abundance of benthic macroinvertebrates in the Upstream Reference and Thermally Exposed zones during all seasons of the year. Forage fish were abundant and comprised a large and similar portion of the fish assemblages in both the Upstream Reference and Thermally Exposed zones. Benthic feeders and top predators, while less abundant than forage species, similarly showed no difference between Upstream Reference and Thermally Exposed zones. The composition of the aquatic community in the Thermally Exposed zone shows the presence of the necessary trophic levels similar to the Upstream Reference zone, indicating that the structure of the community has not been adversely impacted by exposure to the Facility thermal discharge.

2. *Presence of necessary food chain species*

   The fish collected during the biological monitoring program represented feeding guilds from planktivores through top predators. Fish in each feeding guild were similarly abundant in the Upstream Reference, Thermally Exposed, and Downstream zones. Forage fish and top predators comprised similar proportions of the fish community in all three zones. All the necessary food chain species were found in the Thermally Exposed and Downstream zones, again demonstrating no prior appreciable harm.

---

[5] ASA 2019 Section 7 *Master Rationale* p 7-1.

[6] The following eighteen criteria and findings are copied (with minor changes for context) from ASA 2019 Section 7.1 *Indicators of Appreciable Harm* p 7-1.

3. *Diversity*

Diversity profiles for the fish and benthic macroinvertebrates show that diversity in both assemblages was similar among the Upstream Reference, Thermally Exposed, and Downstream zones across gears and seasons. In the fish assemblage, forage and rough fish were the primary groups comprising the assemblages in each of the three zones. Total fish abundance and dominant fish species were also similar across zones. In addition, the temporal analysis of the electrofishing data showed that fish assemblage diversity and composition has remained similar in both the Upstream Reference and Thermally Exposed zones over time. Thus, the evidence shows that diversity is being maintained and has not been adversely impacted as a result of exposure to the Facility thermal discharge.

4. *Capability to sustain itself*

The assessments completed by ASA provide evidence that the biological community near the Facility is self-sustaining. The predictive analysis demonstrated the absence of significant mortality as a result of exposure to the thermal plume for all life stages of the selected representative important species, even under worst-case exposures. Similarly, representative important species growth and development will not be negatively affected by the thermal discharge. As a result, exposure to the Facility discharge is not expected to pose any adverse effects on the ability of the populations to sustain themselves. This conclusion is supported by the retrospective analysis which showed multiple year classes and life stages evident in fish assemblage in the current study, no substantial shifts in the fish community over time, and no substantial changes in the current fish or benthic macroinvertebrate assemblages between the Upstream Reference and Thermally Exposed zones.

5. *Lack of domination of pollution (heat) tolerant species*

Both fish and benthic macroinvertebrate assemblages were dominated by heat tolerant taxa in both the Upstream Reference, Thermally Exposed, and Downstream zones and the abundance of heat tolerant taxa was similar between zones. In general, heat sensitive taxa comprised only small proportions of the assemblages in each zone. The temporal

analysis of the fish data show that heat tolerant taxa have not increased in the Thermally Exposed zone over time and remain at proportions similar to those in the Upstream Reference zone. The temporal and spatial retrospective analyses provide evidence that the Facility's thermal discharge have not caused pollution/heat tolerant and nuisance species to become a dominant part of the fish or benthic macroinvertebrate assemblages.

6. *No increase in nuisance species*

Species of Asian carp, including bighead, silver, and grass carp, are among the most notable non-native, nuisance species now present in the river. The invasive Asian carp have become increasingly abundant throughout the entire Lower Missouri River through a process of range expansion following their accidental escape into the Mississippi River basin, which is clearly not due to the Facility thermal discharge. Many of the fish classified as rough fish, including the Asian carp, common carp, and possibly gizzard shad can be considered nuisance species. The proportion of rough fish in the Upstream Reference, Thermally Exposed, and Downstream zones was shown to be similar. The proportion of rough fish in the Upstream Reference and Thermally Exposed zones has also remained similar over time. Hence, the Facility thermal discharge has not caused an increase in nuisance species.

7. *Increase or decrease of indigenous species*

The bed, banks, and flow regime of the Missouri River have been modified and managed for navigation and flood control over many decades prior to the start of the Facility thermal discharge. Such river-wide modifications and loss of the natural riverine flow regime and habitats have greatly influenced the abundance of native species and affected the overall composition of the fish community. It has been reported that many native fish species are now rare, uncommon, or decreasing in abundance across part or all of their previous range as a result of this extensive habitat modification. In many reaches of the river, the abundance of non-native species has become greater than that of native species because of their greater tolerance for river-wide changes, modifications and loss of the natural riverine flow regime and habitats. These changes to native fish populations have occurred in response to irreversible river modifications that are unrelated to the Facility thermal discharge and would have resulted in the absence of the discharge altogether. The

temporal retrospective analysis shows that the fish assemblage represented in electrofishing samples was comprised primarily of rough fish in both the Upstream Reference and Thermally Exposed zones both in the historical as well as recent studies. The overall composition of the electrofishing assemblages was similar between zones and over time. These results demonstrate that the thermal discharge has not resulted in a decrease of indigenous species either locally or in the Lower Missouri River.

8. *No decrease in threatened and/or endangered species*

The pallid sturgeon is the only federally endangered species potentially in the vicinity of the Facility. Available data suggests that this species is declining throughout the Missouri River due to factors such as upstream dam and reservoir construction, reduced river water velocities and low bottom dissolved oxygen levels. Consequently, the river wide decline of pallid sturgeon is unrelated to the Facility's thermal discharge. Furthermore, there is no evidence that the thermal discharge has eliminated designated critical habitat areas for pallid sturgeon in the Lower Missouri River.

9. *No habitat exclusion due to temperature*

Under typical plant operation, five of the seven representative important species would experience no habitat exclusion. Walleye and sauger are not typically abundant in the Lower Missouri River near the Facility during the summer period, since ambient river water temperatures are above their thermal tolerance limits. Under worst-case conditions, both gizzard shad and white crappie may experience some habitat exclusion along the southern shoreline just downstream of the Facility. Ample alternate habitat exists for gizzard shad and white crappie in the vicinity of the Facility that would offer temporary refuge from the elevated temperatures. For pallid sturgeon, little to no habitat exclusion is expected due to their expected heat tolerance. The predictive assessment demonstrates that substantial areas of habitat would not be excluded for all representative important species.

10. *Maintenance of a zone of passage*

Under typical plant operation, five of the seven representative important species would have the entire river cross-section available for passage. Under worst-case conditions,

gizzard shad and white crappie would have approximately half of the river cross-section available for passage. Walleye and sauger are only expected to be in the vicinity of the Facility during spawning migrations which occurs during cooler times of the year. At these times, no blockage of passage is expected for these species. The predictive assessment demonstrates that a zone of passage would be maintained at all times for all representative important species.

11. *Change in commercial or sport species*

ASA's retrospective spatial analysis shows the abundance of game fish is approximately equal in the Upstream Reference, Thermally Exposed, and Downstream zones, combining all seasons and gear types. Game fish also comprise approximately equal percentages of all fish in each of the three zones. The temporal analysis shows that there was a slightly higher abundance of game fish collected in the historical Thermally Exposed zone electrofishing study than the present study. These analyses provide no evidence that the Facility thermal discharge has resulted in a change or decrease in the number of sport or game fish.

12. *No habitat former alterations*

ASA's screening analysis concluded that the river near the Facility was found to be an area of low potential impact for habitat formers due to the river's velocity, turbidity, and silty substrate which were limiting factors to the colonization and development of habitat formers. These conditions, along with physical alterations to the river shorelines and persistently unstable substrate conditions demonstrates that the absence of habitat formers in the vicinity of the Facility is not related to the discharge and, even in the absence of the discharge, habitat formers would not be able to colonize the area.

13. *Magnitude and duration of any identifiable thermal effects*

ASA's retrospective and predictive assessments show that there are no discernable effects related to the Facility thermal discharge outside of the Discharge zone, which is within the allowable mixing zone. The hydrodynamic modeling of various scenarios, including the most extreme discharge scenario over the last 17 years of operation, shows that the elevated temperatures in the thermal discharge are rapidly attenuated after the

confluence of the discharge with the Missouri River. At the most upstream end of the Thermally Exposed zone, mean daily temperatures within the thermal plume are, at most, 6°F above ambient. In addition, the thermal discharge is typically less than 5 percent of the Missouri River flow and the duration of any exposures are usually brief, transiting through the upper portion of the thermal plume within an hour and a half.

14. *Sublethal or indirect effects*

These types of effects are primarily related to reproduction and growth and may be experienced should the river temperatures fall outside of the range of optimum spawning and growth temperatures for individual species. ASA's predictive assessment shows that all representative important species may experience slightly earlier spawning and increased growth rates under the worst-case conditions associated with the thermal discharge. Little to no difference in spawning or growth rates are expected under typical plant operating conditions. These results demonstrate that no adverse effects on reproduction or growth are associated with the thermal discharge.

15. *No thermal effects on rare or unique habitats*

There are no habitats in the Thermally Exposed or Downstream zones designated as "unique or rare" for this portion of the river.

16. *Presence of critical function zones within thermally exposed areas*

There are no critical function zones (e.g., critical spawning and nursery areas) present within the Thermally Exposed and Downstream zones for any representative important species. ASA's predictive assessment also showed that there would only be minor episodic exclusion from a small area of habitat within the Thermally Exposed zone and only under worst-case exposures.

17. *Trends in the aquatic community*

ASA's retrospective analysis shows diversity was similar over time and between the Upstream Reference and Thermally Exposed zones. Both Upstream Reference and Thermally Exposed zones showed similar composition over time with the community being dominated by rough fish (e.g., Asian carp, common carp, gizzard shad) with game fish

representing the next most dominant group. Most of the fish assemblage in the Upstream Reference and Thermally Exposed zones were heat tolerant and they comprised a similar percentage of the assemblage over time and among zones. A standardized difference test combining the results of multiple community metrics showed that the differences between the zones was inconsequential and demonstrate no appreciable harm to the aquatic community.

18. *Interaction of the thermal discharge with other pollutants*

In addition to the direct effects on the aquatic organisms, heat added to aquatic environments has the potential to impact the balanced indigenous community through the additive or synergistic effects of heat combined with other existing thermal discharges or other pollutants in the receiving waters. In the Lower Missouri River, there are no other sources of thermal discharges anywhere near the Facility such that there would be any overlaps of thermal plumes or their effects. Hence, there is no potential for additive or synergistic effects of the Facility's thermal discharges with any other thermal discharges.

Thermal discharges, alone, have the potential to interact with other pollutants and other water quality parameters through various physical, chemical and biological processes to increase their negative effects on aquatic ecosystems. The existence and magnitude of such effects will depend on site-specific conditions, including the magnitude of pollutant concentrations and degraded water quality conditions as well as the magnitude, spatial extent and frequency of occurrence of elevated temperature exposures.

The area of the Lower Missouri River near the Facility is considered degraded as a result of nutrient loadings, toxic chemical contamination, bacterial contamination and low dissolved oxygen concentrations. ASA concluded that there was little likelihood that the Facility's thermal plume would exacerbate the potential negative consequences of each of these measures of pollution.

In summary, ASA used its screening analysis, retrospective assessment and predictive assessment to evaluate multiple decision criteria identified by the USEPA for assessing appreciable harm. In each case, the available data and analyses demonstrate that the decision

criteria were satisfied indicating that no prior appreciable harm has occurred as a result of the Facility's ongoing thermal discharge. Furthermore, ASA concluded that continuing to allow a 316(a) variance (entailing the parameters defined at Part III below) will ensure the protection and propagation of the balanced indigenous community in the Lower Missouri River.

This analysis demonstrates that there has been no appreciable harm to the BIC due to historic discharges from the Facility. The Facility has been in operation for approximately fifty years, and during that period it has operated in compliance with thermal effluent limitations that are less stringent than the applicable WQBEL. Based on these findings it is apparent that an alternate thermal effluent limitation less stringent than the WQBEL can be permitted while still ensuring the protection of a balanced indigenous community in the lower Missouri River.[7]

[7] Indeed, the showing of no appreciable harm in ASA 2019 supports continuation of the prior 316(a) variance effluent limitations. Ameren, however, is instead requesting the alternate effluent limitation provisions reflected in Part III below.

III. PROPOSED ALTERNATE EFFLUENT LIMITATIONS

A retrospective analysis of Facility operations between January 1, 2002 and December 31, 2018 shows that the Permit's final thermal effluent limitations, had they been in effect, would have been met all year long for most years. However, meeting the current thermal effluent limitations would have been a challenge during July and August of some years, as well as during one period in November 2006 when river flows were quite low.[8] The most challenging year would have been 2006 which entailed high river temperatures in the range of 86°F to 89°F and river flows down to approximately 25,000 cfs. If those 2006 conditions were to occur again in the future, the Facility would have to severely curtail electricity production to attain compliance with the current water quality based thermal effluent limitations of the Permit.

While the above-referenced retrospective analysis indicates that extreme conditions giving rise to potential non-compliance with the current thermal effluent limitations occur only about 1% of the time over the long term, it also indicates a higher frequency during some years. For example, the extreme conditions occurred on 6% of the days in the year 2006, and during 4% of the days in year 2012.

While operational controls may be able to reduce the potential for exceedance of the final thermal effluent limitations during some extreme conditions, they cannot reasonably or practically eliminate that potential under all conditions. For example, if upstream river temperatures are at or near 90°F, the only mode of operation that could result in strict compliance with the Permit's thermal effluent limitations would be a complete shutdown of the Facility and, hence, the cessation of electricity production. During such high temperature times, the need and demand for electricity from the Facility is likely to be quite high and essential to human health, welfare and safety. Shutdown of the Facility at those times would have severe negative human and societal consequences. Consequently, it is anticipated that there will be rare periods during which the Facility must generate electricity but is precluded by extreme river conditions from doing so in strict compliance with the Permit's current final thermal effluent limitations. Variance-based thermal effluent limitations which recognize this

[8] The Facility complied with then-applicable thermal effluent limitations during these periods. Those thermal effluent limitations were based on a prior 316(a) variance under a prior NPDES permit which did not expressly contemplate the use of operational controls.

infrequent need to operate during extreme conditions, but which otherwise apply thermal effluent limitations substantively similar to the water quality based effluent limitations currently in effect, is warranted. More specifically, given the ASA determination discussed in Part II above, that variance-based effluent limitation should allow an annual TDP exceedance rate of 6%[9] which is characteristic of the historic operation of this Facility and which has not resulted in any appreciable harm to the BIC. Based on the findings of the biological monitoring program showing no prior appreciable harm to the BIC, continued discharge from the facility at the same level as that which has historically occurred will not result in future appreciable harm to the BIC.

[9] This proposed exceedance rate is substantively similar to the annual exceedance rate allowed for the Mississippi River under 10 CSR 20.7031(5)(D)5.

IV. 316(A) VARIANCE REQUEST

The great volume of studies and reports completed by Ameren over the past four years provides a wealth of data and insight into the temperature distribution and dynamics of the Missouri River. These include:

- Several grab temperature data collection surveys along the depth, width and length of the river during critical conditions;
- Continuous temperature monitoring for two years at several locations throughout the river;
- Two years of biological data monitoring over a range of conditions in the river for benthic macroinvertebrates and fish;
- Development of a mathematical model of temperature distribution in the river;
- Development of an operational control algorithm at the Facility that can be used to reduce heat load to the river during extreme conditions.

This body of work provides a highly detailed level of understanding of the temperature regime in the river that is not normally available. Completion of the extensive 316(a) monitoring program required by the Permit has demonstrated that the Facility has not caused appreciable harm to the balanced indigenous community of organisms in the river, and continued operation of the Facility as it has been operated for many years will ensure protection and propagation of the balanced indigenous community of organisms.[10] Variance-based thermal effluent limitations which allow exceedances of a TDP effluent limitation of 0.95 no more than 6% of the days in a given year will similarly cause no appreciable harm.[11] ASA 2019 provides independent expert assessment of the river ecology supporting these conclusions. The mathematical modeling and temperature survey data have shown that an adequate zone of passage exists for fish even under critical conditions, and that the extent of the thermal plume from the Facility discharge is sufficiently limited in extent such that it does not cause

[10] ASA 2019 *Executive Summary* p. IX, and *Section 7.3 Overall Conclusions* p. 7-9.

[11] ASA 2019 *Executive Summary* p. I, and *Section 7.3 Overall Conclusions* p. 7-9.

appreciable harm to the macroinvertebrate community as summarized in Part II of this document. The model has enabled the development of a dramatically improved effluent limitation, the TDP, that accounts for the key variables that determine temperature distribution in the river.[12]

Compliance with the TDP effluent limitation of 0.95 ensures compliance with the thermal water quality standards for the Missouri River with at least a 5% margin of safety. Those standards specify that, outside of a mixing zone, the temperature in the river shall not exceed 90°F nor be more than 5°F above the background river temperature. The mixing zone is defined as 25% of the river cross sectional area or volume. As noted above, under extreme conditions of low flow or high background temperature, there exists a potential for exceedance of the standards.

Alternatives to water-quality based and technology-based standards are permitted where *"biological surveys performed in response to section 316(a) of the federal Clean Water Act (or equivalent) indicate no significant adverse impact on aquatic life"*. [10 CSR 20-7.031(5)(D)6.] Ameren has completed the necessary biological surveys, and they support an alternate effluent limitation under CWA Section 316(a). The alternate effluent limitation proposed by Ameren is substantively similar to the water-quality based final thermal effluent limitations of the Permit. The alternate effluent limitations would, however, provide an exception allowing higher TDP values no more than 6% of the time in any individual year. Based on the information provided herein and in the volume of studies and reports cited herein, Ameren requests the retention of the Permit's TDP effluent limitation with an exception for certain extreme conditions as an alternative effluent limitation under CWA 316(a). That exception could be reflected in a modified or renewed NPDES permit through the following proposed text for a Note to "Table A-2 Final Effluent Limitations and Monitoring Requirements" in the Permit.

> *A Thermal Discharge Parameter (TDP) value greater than 0.95 is permitted when upstream river flow is less than 40,000 cfs, or background river temperature is greater than 87°F. The size of the Mixing Zone shall be less*

[12] See 2016 and 2017 reports by Kleinfelder.

than 40% during these conditions as calculated by the equation in Note 5. This exception shall not occur for more than 6% of the days in a calendar year.

These proposed variance thermal effluent limitations are consistent with continued operation of the Facility in a manner in which it has been operated for many years, the consequence of which has been no appreciable harm to the biological community. These limitations ensure a zone of passage outside the mixing zone of at least 60% of the river during extreme conditions; a zone of passage of at least 75% will exist at all other times.

The variance-based thermal effluent limitations should also reflect modification of the TDP equations as stated in the Permit. Those thermal equations for determining compliance with the temperature requirements were derived to cover scenarios where the rise in temperature from intake to discharge ranged between 25°F and 50°F. This range was chosen based on study of the history of temperature rise from intake to discharge which determined that there were few instances when that temperature rise was outside this range. Undertaking the additional effort to complete model simulations and derive compliance equations outside this range was thus determined to be unnecessary at that time. Furthermore, the 2017 Modified Permit accommodated instances where temperature rise would fall below 25°F by restricting the discharge to the requirements applicable for a discharge with a temperature rise of 25°F. This was a safe and conservative measure with which the Facility could comply.

However, based on the evaluation of the operational controls needed to achieve compliance during extreme river conditions as presented here and in the Kleinfelder June 2018 report, it was determined that the frequency of occurrence of temperature increase below 25°F may become more common in the future. Consequently, it is recommended that the thermal equations be expanded to cover a temperature increase from intake to discharge over the range 10°F to 50°F. Revised thermal equations (which follow the same format as those equations currently in the Permit) reflecting this expansion have been derived and are set forth below in Table 1. These equations should be substituted for those of Note 4 of Table A-2 of the Permit. A complete proposed modified Note 4 is provided in Table 1 below.

In summary, Ameren's 316(a) variance request proposes to establish an alternate effluent limitation which is substantively the same as the current final TDP effluent limitation of the

Permit with an exception to account for infrequent extreme river conditions and a formula improvement to more precisely account for certain discharge temperate ranges. This variance can be easily incorporated in the Permit via (1) the addition of the above proposed Note to Table A-2 of the Permit, and (2) modification of the current Note 4 of Table A-2 of the Permit.

Table 1: Recommended Permit Modification to Accommodate Low Temperature Rise

Note 4: Thermal Discharge Parameter (TDP) is a derivation from site-specific model solutions of the thermal plume created by the discharge from Outfall #001 into the Missouri River. Thermal Discharge Parameter represents a combination of stream flow, stream temperature, effluent flow, and effluent temperature, as defined by the equations below, in which the mixing zone is less than 25% of the receiving flow. The numeric effluent limitation, 0.95, incorporates an additional five percent margin of safety to ensure compliance with the water quality standards for temperature, maximum of 90°F and maximum change of 5°F, at the edge of the thermal mixing zone. Additional requirements are found in Special Condition #19. TDP shall be calculated using the following equations:

When Ts < 80°F:

$M2 = 0.00006024 (Te - Ts)^2 - 0.00604124 (Te - Ts) + 0.20470357$

for (Te – Ts) between 20°F and 50°F.
If (Te – Ts) < 20°F, set (Te – Ts) = 20°F.
(Te – Ts) shall not exceed 50°F.

When 80°F ≤ Ts ≤ 85°F:

$M2 = 0.00006024 (Te - Ts)^2 - 0.00604124 (Te - Ts) + (-0.000200 Ts + 0.220704)$

for (Te – Ts) between 20°F and 50°F.
If (Te – Ts) < 20°F, set (Te – Ts) = 20°F.
(Te – Ts) shall not exceed 50°F.

When 85°F < Ts < 90°F:

$M2 = (-0.362 Ts + 32.578) (Te - Ts)^{-0.925}$

for (Te – Ts) between 10°F and 50°F.
If M2 > 0.108 (10.8%), set M2 = 0.108 (10.8%).
If (Te – Ts) < 10°F, set (Te – Ts) = 10°F.
(Te – Ts) shall not exceed 50°F.

Qe = Effluent flow from Outfall #001 in cfs.

Te = Effluent temperature from Outfall #001 in °F.

Qs = Stream flow minus intake flow in cfs.

Ts = Stream temperature in °F.

M1 = (Qe / (Qs + Qe))

TDP = (M1 / M2)